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Magazine

January/February 1961

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Alfred P. Oppenheim, advertising manager
Systems and Procedures Magazine
55 West 16th Street
New York 11, N.Y.
CH 2-1311

Systems & Procedures Magazine

Vol. 12 No. 1 — Issue No. 45

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Published bi-monthly and copyrighted 1961 by Systems & Procedures Association
817 Penobscot Bldg., Detroit 26, Mich.

Subscription rates: Two years, $10.00; one year, $5.50; Single copies, $1.50; Foreign rates; $12.00, $6.50 and $1.57. (Each member receives a subscription as part of his dues.)

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IMPORTANT ANNOUNCEMENT:

The number of issues published annually has been increased from four to six, publication months being February, April, June, August, October, and December.

Application to mail at second class postage rate is pending at Detroit, Michigan.

Single reprints of articles in this issue are available at $.10 each, quantity prices available on request.

Introduction to Systems & Procedures

PART I

A. Richard DeLuca

Mr. A. Richard Le Luca wrote a treatise about systems and procedures work as part of the requirements for a Master of Business Adinistration degree from New York University. It contains 5 parts. The editors of *Systems & Procedures* decided that the entire thesis may be of interest to our readers, so one part will be published in this issue and each of the next four issues:

* * * * *

February, Introduction to Systems and Procedures,

April, Functions of the Systems and Procedures Department,

June, Placing the Systems and Procedures Function in the Organization,

August, Organizing the Systems and Procedures Department,

October, Managing and Operating the Systems and Procedures Department.

Problems of Today's Management

▶ The day is gone when "one-man rule" dominated business. Contemporary management teams are faced with an increasing volume of complex problems involving all aspects of management. Rapid changes in technology, an ever-growing consumer demand for newer and better goods and services, the increasing tempo of business, and an articulate labor force not satisfied by economic rewards alone are some of the elements of our dynamic, industrial society which contribute to these problems. These phenomena constitute a challenge which confronts modern management as it tries to get work done through others by planning, organizing, directing, and controlling the men, materials, machines, and money which combine to form a business enterprise. The increase in management improvement activity is further characterized by such things as the following:

1. An increase in specialists or staff advisors. Such titles as EDP Analyst, Cost Reduction Administrator, Records Management Supervisor, Operations Research Analyst, and Systems and Procedures

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Manager were almost unknown as recently as the mid-forties.

2. An increase since 1945 of some 700 per cent in management consulting activities.[1]
3. An increase in the clerical and administrative workforce, from less than 6 per cent (1870) to about 28 per cent of the present total work-force. From 1950-1955, the white collar group increased by some 1,300,000 persons.[2]
4. The rise of such areas of management activity as Integrated Data Processing (IDP), Automated Data Processing (ADP), Electronic Data Processing (EDP), Operations Research (OR), Systems and Procedures (S&P), Information Technology, and Communications.

Systems and procedures activities, as known today, specialize in improving clerical and administrative operations — the "paperwork" aspects of business enterprise. These activities have arisen in response to management's need for a scientific approach to the paperwork problem.

Office Inefficiency and Its Causes

In most organizations, every movement of money, material, men, and machines must be recorded on paper. This information, once recorded, is then distributed, analyzed, and acted upon in a variety of ways. As they grow, information recording and manipulation activities get out of control, creating information flow bog-downs which deter company-wide efficiency. To avoid this hardening of business arteries, data flow must be constantly reviewed, improved, and controlled.

The following factors are some of those which cause information processing activities to bog down:

1. Inadequate planning of office organization.
2. Inadequate and untrained office supervision.
3. Inadequate procedural control or operating instructions. Many important office operations have never been put into writing so that uncontrolled systems and procedures exist.
4. Poor worker selection which results in sub-standard work by insufficiently skilled workers; some of the routine work is handled by over-qualified personnel.[3]
5. Failure adequately to plan the procurement and use of office machines which results in poor utilization of costly equipment.
6. The preparation of reports and information which in the final analysis is found to be useless.
7. The lack of defined policies (and poor enforcement of those which have been established) which permit a constant "informal" procedural evolution, created, in most cases, through operating necessities. Procedures evolved in this manner are rarely efficient. They often create more red tape than they eliminate.[4]

On the whole, management has yet to appreciate the role which the office can play as an inherent *productive* function of an enterprise — one which "produces" as efficiently (in its own way) as a factory. Management must understand this basic concept if the total enterprise (and for that matter our entire economy) is to operate at maximum effectiveness and efficiency.

Weakness in Modern Organization

Let us put aside for a moment the problems of office inefficiency and look at the anatomy of contemporary organization. We observe some organizational "growing pains":

1. Loss of perspective. Where corporations are segmented into numerous sub-divisions, it becomes increasingly hard for

1. *How the Management Consulting Profession Serves Business Enterprise* (Association of Consulting Management Engineers, Inc., New York, 1959), p. 3.
2. Frank M. Knox, *Integrated Cost Control in The Office* (New York, McGraw Hill, 1958), pp. 1-3.
3. Esther R. Becker & Eugene F. Murphy, *The Office in Transition* (Harper and Brothers, New York, 1957), p. 8.
4. Murray Pape, "Efficiency in the Office through Systems and Procedures" (Unpublished Master's Thesis, Graduate School of Business Administration, New York University, 1957), p. 30.

one person to maintain the comprehensive knowledge needed to guide an overall unit toward an intelligent result. The average manager has an inadequate comprehension of an enterprise's interrelationships. They are too numerous and complex.

2. Intra-organizational scheduling of work becomes highly important — and complicated.
3. Procedures become long and complicated.
4. Operating errors and inefficiencies increase, due to the narrow views of managers who lack the perspective required to unify the efforts of the various organization elements.[5]
5. When responsibility for a system is diffused it is often weakened.
6. Departmentalization, on the other hand, often creates barriers to understanding.
7. Cycle time for performing a total operation is lengthened by the sub-division of functions.
8. Each operating division creates its own systems, records, and controls. This leads to duplication of effort.
9. Costly controls over work-flow become necessary.
10. The volume of record-keeping continues to increase as more and more "controls" are added.
11. Suggestions for improvements require much coordination before they can be put into effect.
12. Individual initiative is dampened by the feeling of being a "small cog in a big wheel." Individual ability is harder to detect and appraise.
13. Narrow loyalties intensify compartmentalization.

The existence of these serious obstacles to optimum organizational performance leads to the following conclusions:

1. Management is either incompetent, overloaded with operating problems, or inadequately trained to cope effectively with these complex problems of modern business enterprise.
2. Management must be better trained and/or provided with staff assistance—administrative services—to help solve and control these problems.

Supervisors and Procedures

When faced with the problem of adding administrative services (a systems and procedures staff group) to an organization, many executives suggest that supervisors can, and indeed should, develop the procedures required by their operating groups. The following limitations of the average supervisor to analyze systems and procedures should be kept in mind:

1. Immersed as a supervisor is in the productive activities of his group, he does not see inter-departmental or inter-functional duplication of effort.
2. Uninformed as a supervisor is about "engineering" an information flow routine, he does not recognize inefficiencies due to poor work flow.
3. Untrained in planning and maintaining controls, work is poorly done or has to be re-done because of inadequate controls.
4. A supervisor does not know how to "functionalize" within his own unit so that excessive or inadequate specialization results.
5. A supervisor does not know how to analyze and control exceptions; hence, too many "exceptions" interfere with good work flows.
6. A supervisor is not trained in the techniques required for conducting systems studies; nor can he write clear, concise, and thorough procedures.
7. In conclusion, it should be observed that criticism of one's own work is difficult if not impossible to perform objectively.

5. Mary C. Niles, *The Essence of Management* (Calcutta, Orient Longmans, 1956), pp. 139-141.

Operating supervisors therefore usually lack basic systems knowledge and the ability to study their own procedures objectively. They become so emersed in daily operating problems that they cannot develop a view of the overall organization. One author has compiled a list of *seventy-five tasks* which she found, through interviews with a large number of supervisors, to be considered by them as supervisory responsibilities. The list does not include systems and procedures "engineering" as visualized in this thesis.[6]

Let us look back now and summarize the chief points presented thus far in this article:

1. Contemporary management is challenged by the ever increasing complexity of modern organization.
2. Office work is characterized by an inefficiency which presents a serious challenge to managerial abilities and effectiveness.
3. Overlying the office efficiency problem is a series of growing pains which further weaken an organization and impair the practice of sound management.
4. Inability of managers and supervisors to cope with information processing challenges without specialized aid stems not from incompetence but from the fact that the complexity of the problems involved requires a variety of talents which few, if any, individual supervisors can adequately master and apply.

A survey of current management literature relating primarily to administration of information processing problems shows that two distinct approaches are emerging:

1. Training—Develop supervisors to handle the problems.
2. Appoint a special staff unit—a systems and procedures function.

Systems and Procedures Defined

SYSTEM may be defined as the integration and organization of a series of tasks or activities in order to accomplish a specific objective of an enterprise. System is one of management's most valuable tools:

> ". . . in any line of endeavor, if a thing is to be done efficiently, it must be done systematically. System, if properly utilized, materially aids in securing the desired results in the best possible way with the least expenditure of time and effort . . .".[7]

Systems Qualities—A business system, to be effective, must possess the following qualities:

1. Provide the *who, how, where, when,* and *why* of all operations required to accomplish its objectives.
2. Generate useful, *current* management information, completely, concisely, and clearly.
3. Provide a broad view of the entire system to all interested management and operating personnel.
4. Be flexible and quickly adaptable to change.
5. Provide increased opportunities for participation.
6. Provide the means for increasing and enhancing the personal skills of those who "man" the system.
7. Provide the best results in the shortest possible time and at the lowest cost.[8]

PROCEDURES are the written and oral instructions which formalize a system. They prescribe the operations which comprise the system. Richard Neuschel defines a procedure as a

> ". . . sequence of clerical operations, usually involving several people in one or more departments, established to insure uniform handling of a recurring transaction of the business. A procedure specifies, either in writing or by custom:
>
> a. WHAT work is to be performed by the various participants
>
> b. WHO those participants are

6. Ibid, pp. 84-86.

7. William B. Cornell, *Organization and Management in Industry and Business* (Ronald Press, New York, 1947), p. 47.

8. For further information about principles of good systems, see Barish, Norman, *Systems Analysis for Effective Administration.* (New York, Funk and Wagnalls, 1950) pp. 14-30.

c. WHEN the various steps in the process are to be performed."[9]

He further describes the vital role which procedures play in modern business as follows:

". . . one of the basic administrative techniques through which the complex business organization acts and by which it coordinates and controls its actions . . . Procedures are the means by which all repetitive business action is initiated, carried forward, controlled and stopped . . . whatever the department—however much judgment, planning, administrative skill, or technical knowledge is required; however variable and non-repetitive its activities—a significant part of its work will always require established routines for getting things done in a prompt, orderly and consistent manner..."[10]

Many procedures in an organization are unwritten. They just grow, a product of informal organization. Procedural growth of this type affects formal procedures in several ways: it modifies, supplements, replaces, or implements them. It makes it necessary to review formal and informal procedure periodically.

In summary, system and procedures provide the media by which management policies and programs are communicated to operating supervisors and personnel, who act upon them. Systems development is, therefore, an *inherent* management function.

How Systems and Procedures Contribute to Better Management

All management problems can be considered to fall into three broad classifications:

1. Determine the objectives of the enterprise—set basic policy as to goals and scope of operations.
2. Determine the persons or groups best qualified to perform the functions required for the accomplishment of objectives, and establish the best methods for organizing and systematically performing the required work.
3. Direct the organization in such a manner that it will operate as an integrated, harmonious system of activities which serves to accomplish the goals of management.[11]

The systems and procedures function traditionally is assigned the primary objective of resolving the second of these problems; namely, to translate management policy into action and develop the simplest, most effective, and most economical means for accomplishing management's goals. Section 2 (April issue) explains briefly the primary tools of systems analysis and attempts to demonstrate the development and application of the systems function to the resolution of management problems in the three problem areas identified above.

Benefits of Systems and Procedures Work

The development and application of the system and procedures function as described in Section 2 of this thesis can produce the following results in (a) Management, (b) Organization, and (c) Operation.[12]

A. *Management Improvement*

1. Increase supervisory effectiveness by providing policies, procedures, reports, and other records which:
   a. Eliminate the need for repetitive decision-making.
   b. Reduce operator training time.
   c. Eliminate unnecessary information, ordinarily included in reports and other records.
   d. Simplify compiling information required for decision making.

9. Richard F. Neuschel, *Streamlining Business Procedures* (McGraw-Hill Book Co., New York, 1950), p. 8.

10. *Ibid.* pp. 6, 7.

11. M. S. Shane, "Fitting Systems and Procedures into the Business Enterprise", *Organizing for Effective Systems Planning and Control* (American Management Association, New York, 1957), Special Report No. 12, p. 39.

12. A synthesis and elaboration developed by the writer from several sources, including the following: Barish, pp. 3-4. Joseph D. Cooper, *Procedural Coordination-Principles and Practices* (Federal Security Agency, Washington, D. C., 1948), pp. 2-3. *Neuschel*, pp. 13-26. *Organizing*, pp. 42-43.

e. Provide a clear presentation of the operational picture, which gives the manager a broader base from which he can formulate plans.

2. Improve management intelligence by developing a logical body of management reports from the complex assortment of financial and operating information generated throughout the organization.

3. Foster the development of managers' analytical abilities and logical thinking by soliciting their participation in the creation of effective systems, procedures, forms, reports, and records.

4. Conserve executive ability, time, and health.

5. Facilitate the development of effective workloads and cost controls.

6. Simplify the application of company policies and practices.

7. Provide standardized means of measuring employee productivity.

8. Establish multi-directional communication channels.

B. *Organizational Improvement*

1. Establish orderliness in the execution of routine tasks.

2. Eliminate unnecessary functions and activities.

3. Eliminate conflicting systems and operations which work at cross purposes.

4. Strengthen the entire organization structure of the enterprise by eliminating conditions and practices which violate sound organizational principles. Since good systems cannot be developed on a superstructure of poor organization, systems analysis discloses such basic errors as misplaced functions, responsibility without authority, obsolete or unnecessary functions, etc., and brings such defects to the attention of management for corrections.

5. Strengthen organization by clarifying lines of authority and responsibility.

6. Clarify line-staff relationships.

C. *Operational and Cost Improvement*

1. Reduce operating time cycles, thereby enhancing the ability to meet schedules.

2. Reduce errors in estimating costs and delivery rates.

3. Lower requirements for, and improve controls over, personnel and material inventories.

4. Reduce working capital requirements.

5. Provide greater operating flexibility through the establishment of preplanned alternative operating routines.

6. Reduce paperwork costs through standardization of clerical operations, forms and reports design and controls, equipment standardization, office layout, etc.

7. Provide working guides for operators: policy and procedures manuals, well-designed forms.

8. Improve morale through written procedures.

9. Increase productivity through the development of management tools for the more effective use of personnel and equipment.

10. Eliminate unnecessary operations and costs.

11. Define the "best available" ways to get things done.

12. Assist in the establishment of cost controls.

13. Insure that work is done in proper sequence, that waste is avoided, and assets properly protected.

Naturally, these benefits of systems and procedures work are attained *only* when systems people are backed by top management and when they have the opportunities needed to perform systems improvements.

The various means employed by systems personnel to achieve the results described above will be discussed in Chapter 2. (April issue). **s/p/a**

Simulation: A New Tool For Management Education*

William H. Fitchthorn

▶ One of the most recent and interesting developments in education for business has been the use of simulation to teach abstract concepts of decision-making in business. Simulation so used has many potentialities for effective teaching in management, yet it has many pitfalls for the unwary. Neither educators nor management training executives of business firms have clear-cut concepts of what these potentialities and pit-falls are. Nevertheless many people in education and in business are devoting much time and effort toward realizing the undeniable potentialities of simulation for more effective education and, possibly, for research in business.

Management simulations are one more device for giving students and executives, especially those at the middle-management level, greater insight into decision-making problems which necessarily are present in all administrative positions in business. One of the big problems in promoting men to high level positions in business is that their specialized experience at lower levels does not prepare them for making overall policies and decisions which affect the total operation of the business. They do not have the perspective of the total business organization as a framework in which to perceive the consequences of decisions they might make with respect to policies and their implementation.

Simulations can give lower-management executives a valuable insight into the complexities faced by top management in sequential decision-making under conditions of uncertainty. This point takes on added significance when one works with students with little or no business experience.

As Teaching Devices

In other frameworks, simulation is equally useful. For example, perhaps it is desired to introduce the concept of a "decision-rule" to production control men who have been using "rule-of-thumb" with respect to maintenance of stock levels and setting of production levels. Adequate stocks must be on hand to fill orders which are receivable in unpredictable quantities. Stocks cannot be kept at such high levels that storage and interest costs outweigh the advantages of being able to ship orders immediately after receipt and low production costs. Nor is it economical to maintain such low stocks that overtime, shift premiums, and other expenses become excessively necessary.

Participation by employees in a simulation of inventory control may show them more realistically than any other means the advantages of having a decision-rule to follow in making reorder decision. Such a simulation can also be used to show marketing executives

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*The writer wishes to express his appreciation to Walter Fleishhacker, a former graduate student at Ohio University, for his assistance in the preparation of this article.

the problems of production management and how they are compounded by poor sales forecasts.[1] Or, take a case from education: An instructor wishes to introduce his students to the subject of inventory control and production scheduling. The students have little conception of the importance of this function to management and the decisions which are involved. A production control simulation can give the insight into the problems of maintaining inventory at economic levels.

Following the development of a top-management simulation several years ago by the American Management Association, the use of simulation — of both the general management and the specific type — as a teaching device has greatly increased until now it seems that no management development program is complete without one or more simulations.

Simulations have been used for years by the armed forces of many nations. However it was the experience gained from operations research which provided the mathematical concepts which underlie many of the business management simulations presently in existence.

At this place, the writer would like to dispel certain misconceptions which have developed with respect to simulations. First, they are not related to the two-party zero-sum game theory developed by von Neumann and Morgenstern some years ago.[2] Second, the entire field of business management simulation is misunderstood by those who think that competitive simulation is just another poker game and not worth using as a teaching device. Evidence accumulated to date clearly indicates that simulations are a useful teaching device, whatever problems may be associated with their use.

Advantages

Simulations have several unique advantages when used as teaching devices. First, and perhaps most important, is the involvement and enthusiasm which they evoke in participants. Discussions which arise among team members often are intense. Participants find themselves staying up at night thinking about past decisions and contemplating decisions for the future. Second is the relative low cost of the game as a training device. Profits are made or losses are incurred, yes—but all on paper. Therefore, there may be some reduction in the actual cost of executive training. Third, the game can compress many decision situations into a short space of time. Participants can acquire experience in handling many different types of problems in that time. Fourth, participation in simulations makes participants more receptive to absorbing information on decision-making than when they attend lectures or even take part in case discussion.

UNIFLO

An example of what is called a functional simulation is the UNIFLO game developed by the Production Control Service of the General Electric Company.[3] This is a production teaching simulation for a flow shop manufacturing a relatively standard product. It shows the participants the desirability of leveling production, the effect of changes in operating levels on costs, and the problems created by uncertain sales forecasts. It also shows participants the desirability of having a decision-rule with respect to establishing economical production rates in order to maintain adequate inventories for filling orders as they are received. Finally UNIFLO shows participants the need to re-examine a decision-rule as underlying conditions change. It is not a competitive simulation.

In UNIFLO, the participant must set monthly levels of production for a product which has a highly seasonal demand. Total sales for the year can be predicted with accuracy, but the actual monthly sales may vary 35 per cent to 45 per cent from projected monthly requirements. Participants must schedule production sufficient to meet orders as they are received and to have an end-of-year inventory of not less than 12,000 units. The umpire does not inform participants of actual sales for a given

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1. John F. Lubin, *Simplified Management Games*. Speech prepared for presentation at the Fourteenth Annual Managment Engineering Conference of the Society for the Advancement of Management and the Management Division of the American Society of Mechanical Engineers, New York, N. Y., April 23, 1959.

2. See John von Neumann and Oscar Morgenstern, *Theory of Games and Economic Behavior*, 2d ed., (Princeton: Princeton University Press, 1947).

3. Lubin, *op. cit.*, p. 5. The writer wishes to thank Mr. G. G. Walker of General Electric Company for granting permission to describe this simulation.

month until all participants have set their production schedules for that month.

This simulation introduces several cost restraints. Overtime operations and second shifts involve added costs per direct labor hour. There is a one-time charge for scheduling a second shift as well as a one-time charge for each reduction in production levels. A monthly inventory charge and a penalty for out-of-stock serves to restrain participants from engaging in extreme strategies with respect to production scheduling.

Other Simulations

The UNIFLO simulation is an example of many functional or special purpose simulations which are available. James R. Jackson described a simulation similar to the UNIFLO developed at UCLA.[4]

An interesting simulation is the Systems Management Administrative Rating Testing which simulates the systems department of a hypothetical company.[5] This department allocates personnel to different projects, subject to the restraints of differential costs for personnel of greater experience, uncertainty as to the savings to be realized from each project, and a total allocation of funds for this purpose. This simulation was developed by the Taylor Management Laboratory of the University of Pennsylvania. This group has also done considerable work in devising other functional simulations. A publication, *Dynamic Management Decision Games*, by Greene and Sisson, describes seven non-computer simulations, most of which are functional.[6] These include a production scheduling simulation, retailing department simulation, etc. Personnel at General Electric Company have devised, in addition to UNIFLO, the following simulations: "Simuload," a master scheduling and loading simulation; and Dispatch-O, a game designed to illustrate problems associated with releasing and sequencing work to the factory floor.[7] These are mentioned only to illustrate the many types of functional simulations which have been developed. Most of these do not require the use of a computer.

Before proceeding further, the writer would be remiss if he did not mention other, and better-known, general management simulations which have been developed. The American Management Association has developed several of these simulations which have been described in various publications.[8] The University of California at Los Angeles, the University of Washington, and Indiana University have also developed simulations for graduate school courses.[9] All of these simulations require the use of computers. A group at the University of Oklahoma has been developing a simulation of the petroleum industry; one interesting aspect of this game is an attempt to introduce the uncertainties of transmitting instructions and information correctly through the channels of communication in management by using the concepts of mathematical probability.[10] Perhaps the most ambitious attempt in simulation construction is the model being constructed at Carnegie Institute of Technology. This is a multi-product, multi-market simulation which requires each team to make over 100 decisions for each play and requires forty-five minutes of computer time to process the data for each quarter of play.[11]

Among general management simulations developed by business corporations, there is

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4. James R. Jackson, "Learning from Experience in Business Decision Games," *California Management Review*, Vol. I, No. 2, Winter, 1959, pp. 92-107.

5. Adrian M. McDonough, "Systems Managers' Administrative Rating Test: Part One," *Ideas for Management* (Detroit: Systems and Procedures Association), pp. 171-173, and John F. Lubin and Leonard J. Garrett, "Systems Managers' Administrative Rating Test: Part Two, *Ideas for Management*, (Detroit: Systems and Procedures Association), pp. 174-182.

6. Jay R. Greene and Roger L. Sisson, *Dynamic Management Decision Games* (New York: John Wiley & Sons, Inc., 1959).

7. These and other simulations are discussed by Lubin, *op. cit.*, pp. 4-7 inclusive.

8. Richard Bellman, *et. al.*, "On the Construction of a Multi-Stage, Multi-Person Business Game," *Operations Research*, Vol. V, No. 4, August, 1957, pp. 469-503.

   John McDonald and F. M. Ricciardi, "The Business Decision Game," *Fortune*, March 1958, pp. 140-142, 208, 213-214.

   F. M. Ricciardi, *et. al.*, *Top Management Decision Simulation: The AMA Approach*, (New York: American Management Association, 1957).

9. For a description of the UCLA Game No. 2, see James R. Jackson, *op. cit.*, pp. 100-104. The University of Washington simulation is described in the following paper: Arnold N. Schreiber, "Gaming—A New Way to Teach Business Decision Making," *University of Washington Business Review*, April, 1958, pp. 18-29. The Indiana University simulation is described in the following paper: E. W. Martin, Jr., "Teaching Executives by Simulation," *Business Horizons*, Vol. II, Summer, 1959, pp. 100-109.

10. William Viavant, "A Management Game for the Petroleum Industry," *Proceedings of the National Symposium of Management Games*, (Lawrence, Kansas: Center for Research in Business, University of Kansas), pp. II-1 to II-3.

11. As described by Peter R. Winters in *Proceedings of the National Symposium for Management Games*, pp. I-3 to I-7.

the simulation of the IBM Management Decision-Making Laboratory,[12] the Supermarket Decision Simulation developed by the Kroger Corporation, a simulation developed by Pillsbury Mills, the simulation developed by G. R. Andlinger of McKinsey & Company, and a rate of return simulation developed by personnel of American Telephone and Telegraph Company. Paul S. Greenlaw has developed a tire marketing simulation since he became associated with Dayton Rubber Company which was played at the recent American Marketing Association annual meeting. Finally, mention should be made of a general management simulation and a casualty insurance simulation recently developed by Nationwide Insurance Company. This is by no means a complete list of the simulations developed in industry. Not all of these simulations are available for general distribution.

The next simulation to be described is an example of a general management simulation. It was developed at Ohio University by Professor E. T. Hellebrandt and a graduate student, Walter Fleishhacker. There are several reasons why the author wishes to use it as an example. First, he is familiar with it and therefore is able to report on some of the experiences that the teaching personnel at Ohio University have had with it. Second, it is a game which does not require a computer to process the decisions of the competing teams, yet the processing time can be reduced to less than an hour after the umpire acquires some experience.

The Ohio University General Management Simulation

The Ohio University simulation is a deterministic simulation set up for four companies (teams) of three to six men each. Each company sells the same product, a consumer item having an initial price of $10 per unit. A greater or lesser number of teams can be accommodated by changing the umpire's worksheets and the total market potential. No attempt is made to structure the organizations of the teams, but most choose to delegate specific functions to different members. All start with the same amount of cash and plant capacity and the same per cent share of the market. Each period of play represents one calendar quarter year of operations. Before a team hands in its decision forms (copies of which are shown in Exhibits 1 and 2), it must make decisions about price, production volume, marketing expenditures (which combine appropriations for both advertising and personal selling), research and development expenditures, investment in additional plant capacity, and sale of existing plant capacity. Each team, of course, makes these decisions having in mind the objective of maximizing long-run profits. These decisions are turned in to the umpire, who processes the data by use of predetermined procedures and forms.

The marketing decisions of each company are used to determine its percentage share of the total market. These percentage shares are applied to the total possible sales for that period to determine the number of units sold by each company in that quarter of play. The combined marketing expenditures, realized product improvements, and price decisions of all companies determine the total penetration of the four teams into the predetermined market potential for that period. It is possible for the four companies to expand the market beyond predetermined potential by extremely aggressive pricing and market expenditures. Any company which has an excess of sales volume over its beginning inventory plus its production for that quarter suffers an out-of-stock penalty in the following quarter of play.

Under no circumstances can the sales of a company exceed its total production for that quarter plus beginning inventory. On the other hand, unsold goods become finished goods inventory which is subject to a carrying charge of 4 per cent per quarter.

The umpire informs each company of its fixed and variable costs each quarter. Such costs are a function of plant capacity. Additional plant capacity may be purchased with a resultant increase in total fixed costs and reduction in unit variable cost, but such added capacity may not be utilized in the quarter in which it was purchased. Plant may also be sold at two thirds of original cost with reverse effect on production costs.

Research and development expenditures are the only factor which is not deterministic. Increasing expenditures increase the *probability*

12. "IBM Management Decision-Making Laboratory, Model 1: Administrators Reference Manual," 44 pp., 1958, and "IBM Management Decision-Making Laboratory, Model 1: Instructions for Participants," 12 pp., 1958.

Exhibit 1

General Business Management Simulation

DECISION FORM

Company _____ _____ Quarter _____ Year

UNITS OF PRODUCTION _____ PRICE PER UNIT ____ BEGINNING CASH $_____

Fixed Cost	$_____	
Variable Cost ($____/unit)	$_____	
Beginning Inventory (_____units)	$_____	
Total Finished Goods Avail. for Sale (_____units @ $_____)	$_____	
Ending Inventory (_____units @ $_____)	$_____	
COST OF GOODS SOLD		$_____
Marketing Expenditure		$_____
Research & Development Expenditures		$_____
Depreciation Charge (1.5% of current plant value)		$_____
Inventory Carrying Charge (_____ x 4%)		$_____
Market Research Information:		
Total Market Potential ($1,000)	$_____	
Own Share of Actual Mkt. ($2,000)	$_____	
Competitor's Unit Sales ($4,000)	$_____	
Total Industry Market Exp. ($2,000)	$_____	
Total Industry R & D Exp. ($1,000)	$_____	
Own Potential Sales ($3,000)	$_____	
SUB - TOTAL	$_____	$_____
Total Expenditures		$_____
Sales Income (_____units)		$_____
NET PROFIT BEFORE INCOME TAXES		$_____
LESS: INCOME TAXES (50% of Net Profit)		$_____
NET PROFIT AFTER INCOME TAXES		$_____
Plant Investment (_____units @ $20. per unit)	$_____	
Plant Disposal (_____units x 2/3 cost/unit)	$_____	

Exhibit 2

General Business Management Simulation

CASHFLOW WORKSHEET

Company _____ _____ Quarter _____ Year

Beginning Cash		$_____
Fixed Cost	$_____	
Variable Cost	$_____	
Marketing Exp.	$_____	
R&D Expense	$_____	
Depreciation Charge	$_____	
Inventory Carrying Chr.	$_____	
Mkt. Research Inf. Exp.	$_____	
New Plant Investment	$_____	
Total Cash Outflow		$_____
Working Cash Balance		$_____
SALES INCOME		$_____
Plant Disposal Income		$_____
GROSS ENDING CASH BALANCE		$_____
Income Tax Charge		$_____
ENDING CASH BALANCE		$_____

STATEMENT OF ASSETS		PRICE (past quarter)	
Beginning Cash	$_____	_____	$ _____
Inventory (_____units @ $_____)	$_____	_____	$ _____
Plant (_____unit capacity	$_____	_____	$ _____
TOTAL ASSETS	$_____	_____	$ _____

of a significant product improvement. When an improvement is obtained, such improvement, in conjunction with price and marketing expenditures, increases the share of market for that company over what it would have been in the absence of such improvement. Failure to make expenditures on research and development in any period negates the effect of all past expenditures. Realization of a product improvement also negates the effect of all past expenditures.

All teams operate under the constraint of limited financial resources. The total outlay for production, marketing, and research and development cannot exceed the amount of cash on hand at the time the decision form is turned in. Thus each team is faced with the problem of making the most effective use of limited financial resources. These resources cannot be augmented by proceeds of bank loans or sale of securities.

Some items of information are supplied each team gratis; other items of information can be purchased. However, the mathematical parameters of the problem are never revealed to the players. At the beginning each team is informed of the approximate trend and seasonal characteristics of product demand. They are also informed that recessions will occur but they are uncertain with respect to timing, length, and amplitude. Occasionally, the umpire sends out a fence-straddling type business forecast letter. Each team is given information on its own production costs, competitors' prices, and the annual financial statements of each team. Net sales and net profits are the only income account items shown on these annual statements.

Information on the following can be purchased:

1. Total market potential
2. Own team's share of market
3. Competitors' unit sales
4. Total industry marketing expenditure
5. Total industry R. and D. expenditures
6. Own team's potential sales. This last item of information becomes useful if the team is losing sales because of inadequate inventory.

It has been stated that the participants are not informed of the parameters through which price changes, marketing expenditures, operating efficiency carry-over, and product improvement determine each company's share of market. Since this is an interacting game, however, the decisions of all teams will affect the outcome of decisions made by any one team. Participants are not informed of the probability that a given expenditure on research and development will result in a product improvement, but they are informed that the cumulation of these expenditures increases the probability of a product improvement. Participants are informed that the parameters respecting these important variables follow well-recognized economic principles. For example, a price decrease will enlarge the share of the market, other things being equal.

Simulation Administration

Proper administration of a simulation is important if it is to be a successful learning experience for the participants. Both functional and general business simulations require detailed but clearly written instructions. The players must be given time to review the instructions as a group, to ask questions, and to consider sample calculations.

The time allotted for decision-making by the teams needs to be carefully controlled. Initially, more time between decisions, perhaps as much as an hour, may be required. As the participants acquire familiarity with the simulation, this can be shortened to ten or fifteen minutes, except for the first decision of a calendar year, when more time is required by the teams to review the annual statements. The time required to process the decision data also serves as a constraint.

End plays must be avoided. To inform teams in advance that the game is to be discontinued after a certain quarter may well result in unrealistic decisions. Price would be cut and marketing, research, and development expenditures eliminated in anticipation of short-term profit maximization. Thus teams should not be notified in advance which decision period will be the last.

It is important that each team keep a log in which it records its decisions and policies

concerning such things as the organizational structure of the team, its basic policies, and their modification with respect to desired rate of return, share of market, research and development policies, and price. Teams may or may not chart such data as company sales and share of market, profit margin of sales, and return on investment. Data in the log becomes important for two reasons. During play the recorded policies and decisions may be referred to by participants as they are confronted with new decision-making problems. Secondly, companies should refer to their logs to justify their policies and decisions when they make their presentations in the critique session.

The Critique

The critique session is perhaps the most important part of the game. It is here that the participants learn what caused the results which they saw imperfectly during play of the simulation. It is useful and instructive to draw charts on which performance of the teams is compared with respect to such factors as unit price, average unit cost, profit per dollar of sales, profit per dollar of total assets, increase in total assets, sales, share of market, plant utilization, and other criteria. It will be recalled that the decisions made by one team affect the results of its competitors. Any mistakes of each team become quite apparent in the results of other teams. The entire group understands the consequences of them.

Up to this point the advantages of simulations as a teaching device have been pointed out and examples of a functional and a general management simulation have been described. At this time it is pertinent to ask what contributions simulations can make for more effective teaching.

1. They motivate students to learn more about the important relations and decisions to be made in a business situation.[13] Students also become more appreciative of what can be contributed by case discussions and lectures. For example, in the 1959 Ohio University Executive Development Program, the general management simulation was started just before students discussed a series of cases on the use of cost data in decision-making. Students remarked how much these case discussions helped them to sharpen their decision-making processes in simulation play. They began to organize their decisions around the concepts of price, volume, variable costs, and contribution to meet factory overhead. They began to realize that the cost of market information, marketing expenditures, and the cost of R. and D. cannot exceed contribution from sales if there is to be a profit. In fact, participants learned that it is not possible to make decisions intelligently without a profit plan in mind.

2. Students become aware of the sequential nature of decision-making.[14] They learn that decisions in one quarter affect decisions in subsequent quarters. For example, a high price relative to that of competitors may result in excessive inventories, with the result that in a subsequent quarter price must be cut drastically to move inventory. The effect of unrealistic pricing on long-run profits over all quarters involved becomes obvious to participants on the team. The sequential nature of simulation decision-making and its impact on participants cannot readily be duplicated by other teaching methods.

3. Simulations impress participants with the principle that decisions made in one functional area have implication in other areas. The effects of the pricing decision also have financial implication and implications for production costs. This interrelatedness among sales, production, and finance gives force to the admonition that companies must plan for the long-term. In too many instances companies go all out on marketing expenditures only to discover that they cannot sell what they produced.

4. Finally, students develop an awareness of how they as personalities interact with

13. Many writers on the subject have remarked about the high degree of motivation which simulations impart. See, for example, Martin, *op. cit.*, p. 101 and Schreiber, *op. cit.*, p. 4.

14. See remarks of William R. Dill, *Proceedings of the National Symposium on Management Games*, p. IV-13.

other participants.[15] This is especially true of games played in Executive Development Programs where the men are away from their jobs. Here they find they do not have status comparable to what they have in their companies. Other participants take them for what they are and not for their position in the organization. They find that their word is not law, that they must learn to come up with sound ideas if they are to be accepted by the group, and that they must time their suggestions correctly. They must be good listeners, too. Two years ago in the Ohio University Executive Development Program, one of the participants engaged in saleswork was put in charge of the marketing activities for his team. He made a detailed sales policy presentation to his team. A staff member who taught marketing and who sat with that team said it was a well-conceived plan. However, other team members did not accept it. In the after-game critique, the thwarted marketing manager stated, "I learned what a poor salesman I really am." Perhaps this was extreme self-criticism because the man has been and is effective in his job. But there is no doubt in the writer's mind that the game made him reappraise the way he had been relating himself to his job and to his colleagues. The writer is certain that other participants have gone through a similar self-appraisal even if they have not always admitted it.

Limitations

Lest the reader think that business management simulations are the answer to management education problems, some of their limitations should be made clear. Like any other educational tool they are useful in certain situations and not so useful in others.

A few teams try to play the simulation as a game rather than as a simulation of a going business. The writer learned informally that in one session of a well-known general management simulation a team composed of several mathematicians deduced the parameters of the game and proceeded to "clean up." They won that particular session but they lost the most important benefit of the game; namely, the problem of making decisions in the face of uncertainty.

In the critique session, a question often asked the instructor by team participants is, "Who won?" Actually, there should be no winner because it is impossible to develop clear-cut criteria for winning. Also, the team that is on top at the end of the play period might not stay on top were play continued. Finally, and most important of all, the person who really "wins" is the one who develops an awareness of decision-making processes involved in business with respect to their type and interrelatedness, who sees the need to learn more about decision-making techniques, and who applies these lessons to his job.

The present state of simulation development generally does not permit including any qualitative influences on the effectiveness of decisions. In most simulations there is no differentiation between a dollar spent on advertising and a dollar spent on personal selling. All dollars spent on marketing expenditures are assumed to be equally effective—although we know that some advertising campaigns are more effective than others. To the extent that spending decisions are not related to the effectiveness with which purchased goods and services are used, simulation is likely to create false impressions in participants unless they are sophisticated individuals. These qualitative considerations as well as the effects of morale and quality of personnel in the lower management levels of the organization are not brought into the simulation.

This brings up a related problem. Simplification necessarily eliminates many decisions which must be made in the real world of business. There are no strikes or other union problems in the general management simulations.[16] There are no problems of formulating and administering a salesman's compensation plan. There is no issuance of new common stock or bonds and the accompanying negotiations and uncertainties. There is no firing of employees and the tensions surrounding this unpleasant task are absent. Many situations,

15. Robert Blake, *Proceedings of the National Symposium on Management Games*, pp. III-1 to III-4.

16. An exception is the Indiana University general management simulation.

such as the O. U. model, provide for the production and marketing of only one product. Of course functional management simulations have been devised to bring out some of these problems, but even there some of the real world is missing. However, we must recognize that these are *simulations*. They cannot be expected to duplicate the real world; nor need they if the purpose of the game has been thought through and the game constructed accordingly.

One problem we have run into is that the participants in our EDP became so involved in simulation play that they neglected other parts of the course. Simulation must be considered as one part of a total learning situation which participants are experiencing. All teaching material, including simulation, must directly relate to the overall objective of the course or program.

A most important problem facing simulation designers and instructors is that they do not know what participants learn from simulations. The decisions which are specified, the parameters of the game, and the feed-back information returned to the participants may be subtly biased to such an extent that the participant gets a distorted concept of decision-making in the real world of business. For instance, he may infer that pricing is always more important than research and development, or that sound marketing information is both easy and cheap to obtain. He may conclude that basic decisions regarding acquisition of new plant and equipment may be made relatively quickly and without detailed analysis of future prices, costs, and volume. Or he may conclude that all business firms experience an upward trend in sales. Using a functional simulation to demonstrate the effectiveness of having a decision-rule is sound only so long as the participant understands that such rules must be constantly re-evaluated. He may make a serious mistake if he applies a decision-rule he adopted in a game to a real world situation without realizing that the factors in the real world are far more complex and subject to constant change.

This leads to a final admonition about business management simulations. Since they are so crude in their present state, it is highly debatable that they should be used to evaluate management personnel. There is no evidence to show that effective performance in a simulation, whatever that may be, is correlated directly with performance on the job in the real world. Also, simulations are characterized by a limited range of decisions and lack of an organizational hierarchy through which decisions are transmitted and from which information is obtained. In their present form they are not a reliable device for evaluating or predicting executive performance. Future developments in this area may, in time, provide some criteria for effective appraisal of management personnel.

A related question is whether or not general management simulations can be used as a testing device for predicting in advance and with considerable accuracy the probable result of following alternative courses of action. Again, the models of *competitive* simulations we have do not duplicate the complexities of the real world in its full competitive aspects. Researchers at the Carnegie Institute of Technology are building a simulation which comes about as close to this ideal as any simulation in existence, but results from use of this game have not as yet come to the writer's attention.[17]

Conclusion

Business management simulations are not a panacea that will solve all teaching problems. Rather, they constitute an effective teaching tool if used properly and in the right situation. Their worth in a specific teaching situation depends on whether or not they are consistent with the purpose of the overall educational program of which they are a part. In fact, designing a business management simulation model requires that the designer first answer the question, "What am I trying to accomplish? But those who are willing to devote time and energy to achieve intelligent solutions of the problems of design and administration associated with simulations will find that their efforts are handsomely rewarded by the motivation it gives participants to learn more about the decision-making process in business.

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17. The research potential of general management simulations was the subject of considerable discussion at the National Symposium on Management Games. See pages III-1 to III-19 of Proceedings.

The Science in Systems & Procedures

Derek V. Baker

▶ The point of view that every person is fundamentally either an artist or a scientist should be encouraging to systems practitioners. The concept of systems seems popularly divided into both categories: the *science* of systems and the *art* of systems.

Contradictory as this may seem, both points of view can be defended in systems work. Science is defined as systematized knowledge in a study while art implies human skill. This dichotomy is inherent in the very nature of the systems and procedures function itself even though the specific manner in which systems work is practiced may differ widely from company to company.

Generally a *system* is the overall program; a *procedure*, the finer details. *System* refers to a series of procedures designed to effect a desired result. *Procedure* refers to the precise detail by which each unit is processed. One may also think of *systems* as the concept, and *procedures* as the legwork or of *systems* as the art and *procedures* as the science.

What systems and procedures has to offer management grows almost in direct ratio to the complexity of the economy in which we live. As management identifies the need and recognizes what systems men can do to meet it, the art and science of systems work will mature.

Time

An important element in developing sound systems and procedures is *time*. Faced with the need to meet deadlines and to get the work done, the line supervisor rarely has time to study systems and procedures. Theoretically, at least, the systems man has the time to investigate, measure, and analyze—this is his job.

Participation

Systems and procedures work is sometimes referred to as organized common sense. This property is not exclusive to systems men but something with which everyone is endowed though admittedly in varying proportions. Witness, for example, the occasional results of employee suggestion programs.

A suggestion program inevitably provides opportunity for participation. For this reason, it should be used. The resultant pooling of common sense will result in systems and procedures which all are most likely to accept.

Getting common sense organized for fullest results takes time. Here again is where the

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systems man comes in. He can create the atmosphere for participation, then interpret and apply the results.

Needs

Of course, there is more to procedures work than time and common sense. There is the need to be sensitive to human relations and to appreciate the need for the type of efficient work performance which affects the productivity of an individual and contributes to our GNP. We need an overall company viewpoint; an intelligent recognition of the effect of intangibles as well as tangibles on the systems and procedures we study. We need the ability to sell ideas to employees and employers—not on the basis of salesmanship ability and personality alone but on that of fully understood and thoroughly explained analytical reasoning.

We need scientific analysis ability to distinguish between possible alternative courses of action. We need the vision to identify alternating circumstances—real or implied. We need the ability to analyze and evaluate circumstances and to anticipate their ultimate environments. We should understand the basic principles and applications of various techniques of investigation and analysis—applications which occasionally seem to conflict with each other. We should be capable of making decisions based on carefully verified facts and be prepared patiently to defend those decisions.

We also need leadership ability—capacity for the *art* of management, if you will — in order to integrate results. Lyndall Urwick, noted international advocate of scientific management says ". . . organization today is a complicated system of cooperation, in which effectiveness (the systems man's objective) is less and less dependent on individual effort, and more and more on the logic of the total design . . . and on the precision with which each individual's contribution is geared to the overall plan . . ."

Naturally we also need to have a good knowledge of the "furniture and equipment" of our trade. This knowledge is a specialty in itself since the array of office hardware is so vast. The systems man should know what is involved in making a good selection. He should know what the equipment can do, how to apply it, which to apply, whether to buy or rent, and, in fact, whether to apply it at all.

The scientifically oriented systems man should develop the capacity to direct his efforts into the channels of greatest effectiveness, and to confine his activities to those spheres of business administration where his peculiar talents are essentially required. He should be able to thwart the perversion of systems work by the fire-fighter type of systems man or by those who look for departmental pedestals at the expense of the organization as a whole. He must have the honesty to leave well-enough alone (when preferable) and not recommend changes for the sake of change.

The scientifically oriented systems man maintains an open mind and seeks opportunities to communicate and exchange ideas with others in the profession. He is as ready to give assistance and advice to colleagues, when asked, as he is to go in quest of aid in his own behalf. He is generous with credit in such cases, thereby demonstrating that systems analysis is no exclusive domain. A past international president of the Systems and Procedures Association stated this concept as follows: ". . . management needs men who have enjoyed, and are enjoying daily, a full life of beneficial experiences, increased knowledge, improved techniques, re-application and redevelopment of skills and tools, in order more effectively to service its complex needs of planning and controlling for constantly improved performance . . ."

Management will find the professional systems men only among those with a scientific—an objective — bent; men who maintain an almost scholarly approach to their day-to-day activity and personal development.

Shifting Sands

Systems men must keep a firm footing on the shifting sands of an evolving systems philosophy and keep pace with its improvement as well as with improvements in systems technique and tools. This development is critical if the systems man is properly to discharge his responsibility of keeping manage-

ment from sclerosis of its communication arteries and if the administration of business is to remain based on the security of an objective sound philisophy. We must not stop short at developing improvement in administrative or productive work. We must offer management controls which are measurable against actual performance defined, spotlighted, and integrated throughout the organization.

Perhaps paramount among factors which affect a systems man's work is the organizational structure. To a large extent the size of the organization determines whether the systems man should be a general practitioner or a specialist. It is interesting to note here that it is being prophesied that the generalist will eventually oust the specialist on the top management team. This does not mean, however, that the need for scientifically conducted systems studies will fade into nothingness. Precision and calculated judgment are always needed and will have to remain. These qualities are our bulwarks. In promoting scientifically conducted analysis, the systems man's goal is to increase the effectiveness of systems, procedures, methods, scheduling, controls, coordination, organization, layout, production, etc. wherever possible throughout his organization.

It is impossible to achieve such systems status and effectiveness without the application of the scientific know-how and technique. This is illustrated by the frequently encountered concept of systems and procedures as work simplification dressed in its Sunday best. Whatever the systems level, whether forms design, an analysis of space, or top management philosophy and organization planning, sound analysis is based on the same orderly procedure. The problem has to be defined and the facts gathered and analyzed before improvement can be developed. Then, of course, resultant changes must be properly implemented—assuming change is necessary. When systems and procedures is stripped to its fundamentals in this way, the unreality of attempting the work on an unscientific basis becomes evident.

The last half-decade has seen scientific management come to the fore. The importance of the scientific method in management is climbing steadily. Systems and procedures people were born to business and industry as practitioners of the scientific method in business problem solving. They were born of a necessity created by the increasing complexity of business and the congestions of our times.

Consider for a moment, the concept of scientific management developed by Frederick Taylor:

1. A true science of work.
2. Scientific selection of the most suitable workman.
3. Scientific education of this workman to perform his work in the best way.
4. Friendly co-operation between supervision and workers.

A similar reflection is found in the thinking of William H. Leffingwell, who highlighted the application of scientific management to the office. In 1921 he enumerated eight so-called basic principles of scientific management:

1. State the problem.
2. Analyze it.
3. Get all of the facts.
4. Find the right method.
5. Find the right person.
6. Train this person.
7. Plan
8. Get the work done.

This list, written some forty years ago, is still acceptable today as a not-so-crude description of the function of the scientifically oriented, professional systems and procedures man.

As the stature of systems work grows, it is increasingly important for us to remember that precision, perspicacity, and perseverance are qualities that we must carry to our every professional activity if we wish to have this growth founded on success and not founded in failure. These are the hallmarks of the scientist and must be demonstrated by systems men. Without them, systems and procedures work will be both ineffectual and illegitimate. **s/p/a**

Policy of a Systems & Procedures Department

Robert C. Coakley

▶ This article about "policies" for a systems department was originally prepared for neophytes and is developed from the point of view that the systems and procedures department should report to the controller; and that recommendations for additional personnel, for terminating personnel, and for wage changes should be submitted to the controller for approval. The department should function in an advisory capacity only.

Some Definitions

Systems, with which a systems and procedures department in an organization is concerned, may be defined as channels through which clerical and administrative activities are handled. They involve the use of special equipment, forms design, and the sequencing of operations. Systems includes determining communication patterns for useful information, usually within the company, for such business data processing vehicles as purchase orders, invoices, and remittances.

Procedures with which a systems and procedures department is especially concerned may be defined as the specific instructions, written or oral, which control the operation of a system.

In some respects systems work is to an office what industrial engineering is to a factory. Where the industrial engineer is concerned with the production of specific saleable items—how to produce them most economically within certain quality specifications—the systems man is concerned with the production of information and how to communicate it most effectively and efficiently to the people who need it to run the business. This type of "production" is sometimes called data processing.

The term *data processing,* or the refinement of raw data into useful information, usually includes *any* actions involved in the regular, formalized, routinized communication of useful information wherever they occur within an organization. Thus a salesman writing a customer's order is processing data. An order clerk coding orders and sorting them by product is processing data. A payroll clerk preparing paychecks is processing data. And, of course, an electronic computer accumulating, measuring, comparing, and editing a sales analysis or production schedule is processing data.

A systems and procedures department represents a functional centralization of the study of these various data processing activities throughout an organization. It normally has the responsibility of surveying the operations of other departments or functions; reviewing their information needs to determine if they are adequate, inadequate, or superfluous; and recommending simplification, consolidation, or

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revision. A systems department also has the responsibility of recommending the most efficient and economical procedures for producing necessary information.

To be effective, data must be timely, useful, and economical. The end product of data processing — reports, invoices, paychecks — must be worth more to the company than the cost of producing them.

In general, then, a systems department should be concerned with *effective organizational communications.* Specifically, and as a means of reaching the general goal, a systems department must concern itself with organizational surveys, work simplification, report evaluation, forms design and control, equipment capabilities, and the study of improvement of clerical data processing activities.

The Steps Involved

The usual procedure for a systems study is as follows:

1. Determine the problem to be studied.
2. Survey the problem setting.
3. Analyze the results of the survey.
4. Make recommendations.
5. Implement the recommendations.

Step No. 1 is of primary importance. It may involve a preliminary survey to determine areas where the effort of the systems men can be most profitably applied. It involves an identification of objectives. The selection of a problem area cannot, however, always be deliberate. Sometimes problems arise which by their nature claim immediate attention. Handling these is often referred to as "stamping out brush fires."

Results of a study may be shown most quickly when the problem area is small, but then the pay-off is relatively minor. Conversely, a large problem area takes longer to handle but the eventual pay-off is greater.

Step No. 2, the survey, is primarily a fact-finding job. It involves sitting down with department heads and clerks, chasing "paper," flow-charting, and determining in detail what is being done, how, when, and why. It involves the collection of forms and report samples. Scheduling, in-put flows of data, and intervals for processing activities must also be estimated.

A good survey demands special skill on the part of the systems man conducting it. He must know how to ask the right questions to get the facts. He must know how to exercise tact and diplomacy to avoid annoying or frightening those being interviewed. He must know how to overcome natural suspicions and resentments of "snoopers," and how to accomplish all that is necessary with a minimum of interference in the regular process of business.

Once the facts are known, step No. 3 is analysis. Step No. 4 goes hand in hand with No. 3. It may involve the elimination, consolidation, or revision of forms and reports, the creation of new reports, re-organization or reassignment of work, mechanization or de-mechanization, computerization or de-computerization of routines, the installation of formalized procedures to replace informal "understandings," or any other proposals which appear advisable as a result of the analysis. An important part of step No. 4 is the effective presentation and selling of the recommendations, and the intelligent modification of proposals when legitimate objections or criticisms are raised.

Step No. 5, implementing recommendations, involves follow-up to see that the recommendations are valid, understood, and properly executed when accepted. It is always possible that the survey overlooked some important exceptions for which provision must be made. Or recommendations may not be understood, and those responsible for using them may modify them, thus destroying some of their value. The systems department must be prepared therefore to provide guidance and training in putting recommendations into effect.

A Systems Department

One may ask why a special department—a systems department—is needed when supervisors are generally quite familiar with the problems of their own departments. Aren't they in the best position to solve these problems, particularly if the systems department is staffed from outside the company as many

new ones are. The following arguments are advanced to justify a systems department.

1. As a staff function, with the single overall mission of efficient and effective data processing *throughout* the organization, it can concentrate its energies exclusively on systems problems, undeterred by day-to-day routine data production operations. Many recommendations which such a department makes will not be new to thoughtful line people; The crux of the matter is that line employees are too involved in meeting daily deadlines. They do not have time to plan for methods improvements.

2. When an outside agency, staff department, or consultant is used for systems work, the systems man is likely to have an objectivity or broad perspective which does not come easily to the busy line administrator. A systems analyst gets not only a big picture from department heads but also detailed pictures from the clerks.

3. A systems staff group often opens new channels of communication between organizational units, thus providing for the exchange of information not otherwise exchanged. It may also uncover channels which are no longer necessary. For example, the analyst may find that a certain report, prepared in triplicate and routed to three different departments, apparently is no longer necessary. Each department involved admits that it can now get along without it. The original need had long been forgotten, but no one thought to question the form because each assumed that someone else needed it. The report is then discontinued.

4. A good systems department is composed of analysis specialists, with a broad knowledge of equipment and techniques peculiar to data processing needs of business management.

5. The systems survey function, if properly structured within a corporation, can operate very satisfactorily even when the analyst is new to the type of business represented by his corporation. That is, it eliminates a large part of the handicap of lack of company experience. The systems man has an analytical mind, he is trained to grasp a problem or a situation in terms of the whole and then break it down into workable components that he can cope with satisfactorily. He can learn about the company much faster than he can learn to be a systems man.

In Conclusion

The systems group, then, serves as a central administrative methods and systems planning and coordinating unit, trying to coordinate and make more effective data processing services for corporate management and operating supervisors alike. Its purpose is to insure optimum effectiveness of company operations by planning, organizing, and auditing a company wide integrated data preparation and flow, data summarizing, and management reporting.

For special assignments, the systems department should report to the head of the unit requesting the service.

The broad functions of a systems group may be summarized as follows:

1. To develop systems for providing management and operating supervisors with more meaningful and timely information for their use in making short and long-range policy and operating decisions.

2. To make it possible for management, through an integrated system of information reporting and data flow leading to the preparation of carefully planned and scheduled reports, effectively to relate production scheduling, inventory control, and sales forecasting for greater efficiency, increased customer service, lower costs, and increased profits for the company as a whole.

3. To eliminate unnecessary data processing systems summaries and reports, and to strengthen the necessary ones.

4. To play an active part in the continuous process of keeping staff and operating personnel informed of methods and systems needs and developments.

5. To keep itself and management informed about administrative information requirements. **s/p/a**

Selecting Computer Programmers: a Conservative Approach

Donald G. Livingston

▶ Estimates of the need for EDP and scientific programmers during the next five years have ranged from 50,000 to 170,000. The large majority will be EDP programmers if business conditions remain as they are or improve. If business continues to follow the same practices as those reported in a recent BLS survey[1], a modest estimate is that ten people will be screened for every one programmer trainee finally selected—the total amounting to, say, a half-million more or less complex screening decisions to be made. How can this be done? What methods are available for economical, efficient programmer selection? What methods have been shown to work?

For purposes of this article, discussion will be confined to EDP personnel. The problem of selecting scientific programmers is different from that of selecting other personnel because of educational qualifications and because the pool of suitable personnel from which they may be drawn is small.

In outline, the task of programmer selection is no different from that of selecting any other employee for a specific job. In detail, however, programmer selection raises nearly every technical problem of selection theory. The reasons for this are:

1. There is no adequate, consistent definition of what a programmer is or does. Within the same firm, "programmers" bearing identical titles at adjacent desks may be occupied with quite different duties. In the absence of a stable job description, what work must a candidate be able to perform? What are we to look *for*?

2. There is inadequate psychological theory for defining the specific intellectual abilities a programmer needs. We know vaguely, for instance, that certain high-order abstract, conceptual, or organizing abilities are required, but there is poor psychological understanding of what these abilities may be or how they are defined and measured. Since we do not know what it takes to be a good programmer, what are we going to look for and measure in a candidate?

3. Measures of programming proficiency are rudimentary, judgmental, and impressionistic. If the basis for consistent identification of a "good" programmer is not available, how do we know what "kind" of people to look for? Would we know a potentially good man if we saw one? How can we tell if our selection techniques are working?

The *need* to do *something* to select programmers has caused many to by-pass these problems. There has not been time to worry very much about technicalities. A kind of corporate sigh of relief must have gone out when IBM's Programmer Aptitude Test became available, and most users read more into this test's potentialities than its constructors ever dreamed of suggesting. The fact is that neither PAT nor any other test permits obliviousness to the basic problems of selection. To by-pass these problems is to misuse the selection methods which are available, to reduce the probabilities of getting good programmers,

1. *Adjustments to the Introduction of Office Automation*, U. S. Department of Labor Bulletin No. 1276, May, 1960.

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and, very likely, to waste time and money in the screening and selection process. Answers, of course, to all the problems of selecting programmers are not available and many of the answers we do have are makeshift. Yet with caution and using what we know, it is possible to select the better men.

Define the Job

Several business groups have tried to define the job of a programmer. One reasonably good definition is in a government publication, *Occupations in Electronic Data-Processing Systems.*[2] Other groups attempting to define this complex job have tended to slide toward T. C. Rowan's well-known RAND definition: Programming, he wrote, is "that activity occurring after an explicit statement of the problem has been obtained, either verbally or in the form of equations, and including the determination of programming strategy, flow charting, and coding." Rowan's definition may be too general for many purposes, but it helps to describe the complexity of the job and to serve as a basis for selection. Definitions, whether tight or loose, rarely fit closely to *the* job in a firm. The practical benefit of definitions such as those of Rowan or the USES is that they may call attention to some features of the job which might otherwise be overlooked.

The definition of a job, if it is to be of use, should be in specific, behavioral terms. Insofar as possible, it must tell exactly what a programmer does on the job. An example of this from the USES description is "Corrects program errors by revising instructions or altering sequences of operations." General statements such as "Debugs" are to be avoided, as are judgmental and evaluative comments such as "Must demonstrate patience." "Patience" is not behavior. Analyses which have been constructed for other purposes, such as wage and salary administration, are rarely useful as a basis for selection. Analyses which use judgmental information (e.g., amount of responsibility) do not lead to well-defined selection.

Once a job description is obtained, what is to be done with it? First, it is a source of hunches about *man* requirements (discussed in the next section). Next, it is the basis for Personnel Department responsibilities, providing information useful for hiring, for transferring, and for identifying "Likelies" from elsewhere within the firm. Finally, a thorough job description often helps management understand employee positions better. It may also suggest ways to simplify or reassign work.

Measures

From the outset of a selection activity the measures to be used in selecting a programmer should be clear. Effective selection requires the use of all available data, from whatever source, about a candidate. Interview information, personnel records, references, resumes, transcripts, all the documents and data which may be obtained are potential sources of useful selection information. In the face of a mass of information, however, the determination of what is especially *useful* becomes a complex problem. All of these data provide leads to intellectual, motivational, and personality characteristics of a candidate, but it is necessary to know which of these characteristics are relevant to effective performance on the job.

Everyone who selects personnel has ideas about what he should look for in selecting a man. It has not been so long, for instance, since in selection interviews would-be programmers were asked such questions as "Do you play chess?" The apparent assumption was that intellectual abilities required for chess are similar to those used in programming. The danger inherent in these comparison hunches (and their resulting questions) should be evident. No one, for example, has shown whether a good chess player and a good programmer have the same abilities. There is no reason, either, to think that if a candidate does play chess, he is a good player. How good must he be at chess in order to be a good programmer? The naiveté of such simple questions in selection can thus be seen. Less readily seen are biases and oversimplifications of thousands of hunches and supposed insights which selection people consciously and unconsciously use.

Every assumption about what it takes to be a good programmer should be able to stand the test of verification. If chess-playing is re-

2. Occupational Analysis Branch, USES, January, 1959 (GPO).

lated to programmer success, then it should be possible to demonstrate such a relationship by quantitative means. Any device used as a source of information — a test, a former supervisor's rating, or even an interview — must be shown to contribute valid information to improved selection. It is possible, for instance, that an unvalidated test can in reality lead to anti-selection. That is, the test may be working *against* effective employees. Simply because a device works in one place does not mean that it will have validity or significance for another employer or job. How validation of a test, hunch, or other datum is handled is the subject of the next section.

Validity

Selection matters would be simple if there were some intellectual, motivational, or personality traits on which we could draw thus enabling us to say that job Z required personality traits a, b, and d plus intellectual traits a', x, and c. If this were so, we could easily conduct validation studies and obtain general agreement about requirements for a job.

A number of investigators have come up with trait listings of various kinds, but they either require skilled use or they are unmeasurable. Unfortunately, listings of traits or processes simply do not exist in a trustworthy form; furthermore, modern psychology opposes such a fractionating of the human totality. As a result, even selection experts usually have to take an informed but none the less basically shotgun approach to identifying man-requirements for most jobs. Rowan, for example, started his programmer selection testing program with some thirty different tests. He finally whittled these down to two, the only ones which could be shown statistically to have usefullness in selecting RAND programmers. Such an empirical approach is costly and time-consuming. It defines man-requirements almost solely in terms of test scores. In other words, what happens is that traits and processes go out the window. Instead of identifying them, we substitute test scores. We do not truly understand what traits lie behind these test scores. Nor does it make any difference as long as we get a good programmer. Following this line of reasoning, *any event of information may be a potential predictor of success in programming if it is shown to work.*

The inexperienced user of formal selection devices is prone to take them at their face value, often with serious error resulting. This situation is particularly true of tests, especially so-called "personality" tests of the paper-and-pencil variety. Far too often the novice test user believes he knows what a job requires (*e.g.*, initiative), so he purchases and gives a test which purports to measure what he has in mind (in this case, a test of "initiative"). When the user makes a selection decision upon the basis of such a test, anything can happen. He may be lucky, hence, become a confirmed user of tests. He may be even luckier and find that the test results make no difference in selection. Or, if he discovers later that the people he selected do not have "initiative," he is likely to cry loudly that "Tests are no good." Tests, or any other selection device, are only as good as they are demonstrated to be. There is no inherent selection power in any selection device. Whether a test measures what it purports to measure can only be demonstrated in use in a specific application.

In the present state of the art, particularly as it is practiced by the many firms which will not take the time and money for proper selection, those who wish to assess personality factors in selecting programmers would generally be better off by using other methods than tests. An application blank, properly validated empirically, has frequently been shown to have high predictive value for many jobs in which motivational factors are important (*e.g.*, sales work). Biographical and performance data would generally be safer predictors of personality and motivation than would uninformed, unvalidated "personality" tests.

The assessment of intellectual factors by tests is not quite so hazardous, although the necessity of validation remains. In programmer selection, the use of intellectual measures such as the Programmer Aptitude Test probably helps in screening since it is agreed that intellectual requirements are great in programming. The potential danger lies, however, in using such tests as absolute cut-off guides and without further validation. Without validity, a user who selects only those who earn "A" on the PAT *may* be doing himself a great disservice. He *may* be losing some excellent pro-

grammer personnel. An "A" is a good estimate of the range of intellectual proficiency of a candidate, but there is no reason to suppose that an "A" is required for successful performance in programming job *B* at plant *C*. In fact, one company which went to the trouble of testing the usefulness of the PAT in its own organization found that while the test predicted end-of-course grades very well, unfortunately, such grades bore little or no relationship to subsequent programmer proficiency. An identical validity study of the test in another company may show quite a different picture.

Less formal selection measures are in common use in business and industry. Educational requirements are illustrative of a whole range of such measures. One may also include age, length of service in a company, familiarity with certain systems, sex, and so on. There is no intrinsic reason to suppose that high school graduation is necessary for good programming. In fact, there is some evidence that it is not necessary for much EDP work. There is no necessary reason why age should be a measure for selection, though it seems to be a popular one. In a well-run selection program, all of these informal measures are subject to the scrutiny of validation no matter how self-apparent their usefulness for selection.

The Criterion Problem

For many jobs, identification of a proficient employee is a relatively simple matter. One can count the output, look at a sales record, measure wastage, and so on. There is no such simplicity in assessing the performance in most intellectual work, including programming, but unless we know who is proficient there is no way of knowing whether a selection device really works. To complicate matters further, it is necessary that proficiency be stated in terms which are objective, quantifiable, reproducible, and responsive to real changes in performance.

Evaluations of performance are certainly not new to industry. Most firms use formal or informal assessments for wage and salary purposes, upgrading, promotion, transfer, and many other employee actions. Whether assessments made for these other purposes are useful in *selection* is doubtful. Repeated studies have shown that they rarely are of much value in telling what a man actually does. More often they reflect such factors as length of service, health, and personal liking. Many rating-type assessment schemes fragmentize the assessed person well beyond the point of useful information.

The dimensions or standards which provide the framework for evaluation are known as criteria. Such criteria as have been reported for programmers tend to be "global" in nature, which is to say that they are usually over-all evaluations in such general terms as "suitability to the work" or "worth to the company." Because ratings or rankings made on such generalities are obviously subjective, they tend to differ substantially when different superiors perform assessments of the same employee. To get around this problem — though it certainly does not meet it entirely — pooled supervisory opinions are used or an intensive training of raters is carried out.

Unless the criteria of performance are stable, it is impossible to determine whether a selection procedure is getting the desired employees. The best guarantee of stability is a criterion stated in behavioral terms which specifies what effective programmers do which distinguishes them from ineffective programmers. While other "intellectual" jobs have been so objectified, there are no reports in the literature of such success with programming. Because of this, the would-be user of a selection program is undoubtedly best off if he confines his assessments of men to a simple, preferably single-dimensional ranking on which he can get agreement from others who are in a position to know the men being evaluated. A simple comparison of rankings with test scores or other selection data, while not a formal validity study, can often reveal immediately whether any relationship at all exists between the two. Other inspection techniques such as grouping programmers into "good", "average", and "poor" categories and comparing these classifications with the selection data can achieve the same end despite their technical flaws. Such rough-and-ready techniques sometimes help avoid significant selection mistakes.

It is suggested that those who rank or group men make certain that only men who are per-

forming similar duties be ranked or grouped together. This elementary precaution is sometimes obvious but not always. In a recent study made by the author, for example, no validity was found in an initial comparison of a test's score with a group of programmers ranked on a measure of proficiency. On a hunch the programmers were re-ranked, separating men who worked on the 650 from those who worked on the 705 in the particular installation. In new correlations, the test predicted very well for the 650 group, but not the 705 group. Whether this was attributable to machine requirement differences, different supervisors, or other factors is not now known.

The discussion thus far has tended to emphasize the most common kind of validity study procedure, generally known as the "present employee" method. As suggested in the preceding paragraphs, this method requires comparison of selection data with current performance of employed programmers. This kind of after-the-fact selection study is cheap and easy to do, and it leads to knowledge of what to look for in candidates yet to be screened. Its danger is obvious. That is, if tests are part of the selection data, care must be taken to avoid using measures whose scores vary with experience on the job. It is not appropriate, for example, to give a test to experienced programmers for validation if the test is to be used to select inexperienced personnel and if scores obtained on the test depend on experience.

A second, more costly and time-consuming but more effective means of conducting a validity study requires a wholly empirical approach. Using the "new employee' method, candidates are screened in whatever way is usual in the company. Tests or other data to be tried out as potential predictors are added to the usual selection routine, but the results are not used in the present selection. After the selected men have been on their jobs for a sufficient period to allow adequate observation and evaluation, the data obtained but unused at the time of selection are dusted off and compared with current performance.

Other Considerations

It is unfortunate that the experiences of industry in programmer selection have rarely been published. One attempt, in part, to remedy this defect was the BLS survey to which reference was made early in this article. This survey, which describes the selection experiences of twenty pioneering major users of electronic data processing installations, deserves a place in any selector's library. The only other summary publications available to this author's knowledge, are two studies by the Electronics Personnel Research Group, Department of Psychology, University of Southern California. These studies, made for the Navy, discuss thoroughly the requirements of adequate selection of programmers and maintenance personnel.

In these studies, as is the case in general practice, heavy emphasis is placed on the use of psychological tests in the selection process. It is invariably the case in the literature of the field that the tests employed are of the paper-and-pencil variety, and nearly all purport to measure certain high-order intellectual abilities. The problem of *performance* tests—those which actually require the physical working out of intellectual problems—has been tackled by only one firm. It is probable that such performance tests will be used more in the future, for they seem not only to tap several different aspects of problem-solving but provide for observation of exactly how a candidate goes about his solution.

Finally, a unique kind of problem may arise in programmer selection and development. It is one which may be greeted by some harassed EDP managers with incredulity, but it may contain a warning about screening. In one major installation, work on EDP had advanced to a maintenance stage. This raised the question, "How can we use the programmers elsewhere in the company?" Because the selection of programmers had been performed independently of the selection of general office employees, and because most of the programmers had reached fair salary levels, this was a ticklish problem indeed. Although this is at present a unique problem, it may not remain so. Anyone charged with the responsibility for selecting programmers should be certain, therefore, that his program is well-integrated with the firm's normal selection procedures, so that selection is not just for *programmers*, but for versatile long-time *employees*. **s/p/a**

The Effect of Electronic Data Processing On Audit Procedures

Lansdale Boardman

▶ The relationship of auditing and electronic data processing is a difficult subject. To understand it fully, we should go back of the technicalities and consider the essential fundamentals of auditing.

Auditing Philosophy

It is unfortunate that an auditor's opinion is commonly referred to as a certificate. Actually an auditor is practically never in a position to certify that certain figures are precisely correct. His professional opinion is much more like that of a doctor who looks at the symptoms and history of a patient and then gives his diagnosis of the disease in the light of his past medical experience. The doctor does not guarantee his identification of the ailment any more than the auditor guarantees the accuracy of a balance sheet.

The many audit textbooks which have been published do an excellent job of explaining the most practical techniques for use in situations which an auditor commonly meets in business. However, do not jump to the conclusion that these techniques are standard procedure for all circumstances. When an auditor meets a new problem, he must turn away from technical rules and go back to basic philosophy.

An auditor's opinion is based primarily on two general factors. First, he assures himself that he understands how the financial figures were actually developed. Here he is interested in the way the paperwork actually was handled, a way which may or may not be the same as the formally announced procedures of the organization. Second, the auditor satisfies himself that the methods in use will logically produce financial information which can be considered a fair statement of the facts.

The auditor plans his work in terms of these two fundamentals. Many of his technical procedures are in the nature of spot tests — a review of selected items within each important phase of the company's accounting and related procedures so that he can be reasonably certain of what is being done. This "testing" is appropriate both in the case of manual clerical procedures and in highly automated operations. The exact form and concentration of tests naturally vary with the auditor's judgment of the situation. However, the purpose can be stated in simple English — to let the auditor know what is really going on.

A second major technique of the auditor is concerned with internal control. This usually includes the organization of paperwork and related procedures so that no transactions can be carried out by one employee alone, without having another person automatically check on the reasonable accuracy of his work. Since good internal control is a strong assurance

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of the fairness of summary financial statements, the auditor bases his opinion to a significant degree on the extent of internal control which his review and spot-testing of procedures discloses.

Internal vs. Outside Auditing

For the purposes of this paper, the differences between internal auditing and outside auditing are not significant. They are merely a matter of scope and emphasis. The certified public accountant is engaged normally to express an opinion about the overall financial statements of a company, and it is interesting to note that he often reports not only to the management who retained him but also to various outside parties such as bankers, suppliers, and stockholders. The internal auditor reports only to company management. While he often performs certain audit procedures in close cooperation with the outside auditor, his principal emphasis is usually upon detailed financial statements used for the control of individual departments within the company. Depending upon the policy of his organization, he may even get into the audit of paperwork in a non-financial area such as production control.

Errors and Embezzlement

Discussion of auditing often place emphasis on the subject of embezzlement. It is important to state at the outset that the subject is a red herring and not a fundamental function of auditing except in special cases. Of course, it is the duty of an auditor to report any improper situation which he suspects. He also reviews the internal controls in order to make sure that it is extremely difficult for an employee to arrange a substantial embezzlement. On the other hand, it is not practical, short of maintaining a complete set of duplicate books, to prevent an employee from deliberately altering clerical or EDP records, if he wishes to do so.

Implicit in the audit philosophy which has been outlined is the customary business concept of the calculated risk. The auditor cannot economically check and guarantee every transaction. Proper internal controls will normally catch a great majority of errors which are not noted by the clerk who made them. However, it is not practical to have complete coverage of internal control. An unusual transaction may well be in the hands of only one man. Often good management controls — for example, well conceived budget and actual comparison reports — will serve as an excellent tool for isolating unusual figures. When all is said and done, any system, whether manual or electronic, will have some undetected errors despite the most careful efforts to minimize them. These may be mispostings in a clerical system, miscodings in an electronic system, or incorrect changes and adjustments in either case.

Invisible Records

The invisibility of records has been emphasized as a fundamental factor in electronic data processing. It is important that we realize that there is also much that is essentially invisible in a manual bookkeeping system. There is so much detail on a normal receivables or inventory card that no one auditor can review and consider the implications of each entry, so that some of the postings are, for practical purposes, out of sight. If you have had much experience with a normal bookless bookkeeping system, you know that it is essentially impossible to reconstruct a trial balance as of a previous date unless the "books" were balanced at that time. It is true, also in manual bookkeeping systems as well as in EDP, that posting of inventory activity or of retail receivables activity may be made in summary form only, so that it is difficult to trace in more than a few test cases the complete detail supporting each summary posting.

For purposes of further discussion in this paper, a distinction should be made between punch-card operations and small computers on the one hand and medium- or large-sized EDP operations on the other hand. In the first class, it is customary and practical to "audit around" the machine operation which covers only a small phase of the bookkeeping function. In such cases, the auditor can look at the results of input and appraise them adequately without getting into the details of wiring or programming. Our discussion will be most meaningful, therefore, if it is oriented toward medium and large computer operations.

Basic Audit Practices Unchanged

There has been a large amount of discussion of the changes which computers will force in audit thinking. Certainly the fundamental requirements of understanding what is going on and of being satisfied that the figures make sense have not changed at all. Nor have many specific audit procedures been fundametnally changed.

For example, whether a payroll is on a one-write board or completely on EDP, the internal control philosophy stays the same. The payroll rates should be approved by someone outside of the payroll function. The time cards or piece work reports used as input should be approved by supervisors who are in active control of the work. Payments should be distributed by a pay-master who is independent of the payroll department. It is interesting to note that whether the payroll clerks are directly writing the payroll or are merely screening the input for a computer, their work is essentially a form of continuous audit.

Similar separations of duties are essential in accounts receivable operations regardless of the degree of automation. Cash receipts should be handled by a group which is completely independent of the accounts receivable system. Credit adjustments for customers should not be posted without prior approval by an executive independent of the bookkeeping function. All shipments should be documented at the beginning of a system to assure that all such transfers are billed or otherwise accounted for, and that all bills are posted to accounts receivable.

The same philosophy continues to apply to purchasing and accounts payable functions. Accounts payable should serve as a continuous audit so that payments are made only after matching the vendor's invoice with receiving and purchasing papers prepared or completed in appropriate departments.

The need for separation of responsibility for control accounts and detail ledgers in accounts receivable and elsewhere becomes even more important with EDP. The recent newspaper report of a brokerage embezzlement is a nice case in point. The guilty employee was a senior executive who had an unusual amount of knowledge of the firm's large punched card operation and unusual freedom to work with any part of the records. However, he would not have been able to make the embezzlement if the system had been so designed as to provide a control account (to which he did not have access) over the partners' current accounts. His successful plan was merely to insert unjournalized credits to his own personal account.

Similarly the fundamental audit technique of spot-testing or tracing specific items from the final results back to the source documents or forward from the original data into the summaries has not changed with EDP. An auditor may decide that in an EDP system he need make only light tests checking only a few items, but will find that he still needs to test a part of the payroll register to see whether the computations are correct and properly tied to source documents which he can see, such as time cards and deduction authorizations. In order to be satisfied that charges are being properly distributed to reasonable operating accounts, the auditor will wish to ask for a detailed printout of part of the labor distribution and part of the accounts payable distribution, so that he can test items therein back to their original records.

In cases like these you may see the auditor checking page totals of such listings in the same way that you previously saw him checking page totals of a manual payroll register. This does not mean that he is seriously doubting the accuracy of electronic addition. What the auditor needs to know is that the list of items is complete, representing everything in the total, and not just a special selection.

Audit Problems Changed by Computers

Although fundamentals are unchanged, auditors are devoting special attention to certain aspects of EDP which have changed their problems radically. For example, consider the problem of simple accuracy. An automatic machine is far more accurate than a human being. Unfortunately some people have jumped from here to the conclusion that an EDP operation never makes any mistakes. The fact is that when a computer does make an error, it is likely to apply that error to a whole

series of items, unlike a clerk who miscalculates only one item at a given time. This kind of EDP error can occur either because of a malfunction in the main frame or in peripheral equipment, or it can result from an undetected error in the logic of the program or because the wrong program was used for a given batch of material.

In EDP systems data may be handled by personnel who are not familiar with the pattern of the transactions they are processing. Operators who handle cards are not necessarily as familiar with the usage of company accounts as is a bookkeeper who posts a ledger by hand. This point is not academic and theoretic. It is quite possible for unauthorized data to be run in a computer system. If the work is not planned precisely, it is possible for some data to be run twice and for other data to be omitted entirely from the running. And there is the continuing possibility — almost a certainty — of at least a few errors in master data. These types of danger cause the auditor to put a greater emphasis on his review of internal control factors.

Generally the computer room is a service center rather than a complete system in itself. A man in the computer center should never be able to change an item or to change a procedure without consulting another department. While this rule will prevent certain types of embezzlement, it is important primarily to prevent serious errors made in perfectly good faith. A companion rule is that an employee of a related department may not run an item through the computer center independently. There should be specific regulations about who may and who may not operate the console. There should be reasonable controls over the distribution of output reports, so that appropriate departments will normally be cognizant of what is happening to their data.

On the input side, there is the difficult problem of controlling production data inserted into reporting devices by line employees at remote stations. In some cases it may be helpful to test the reasonableness of the data by logical comparisons performed by the machine. However, there should be a prompt feedback of a transcript of this input to the foreman who is responsible for the operation and, therefore, can be responsible for catching certain obvious errors.

Audit Schedule

With EDP, one of the biggest changes which the auditor must make in planning his own work is in scheduling certain procedures. For example; promptness is essential since it may not be practical to wait until October to test the material distribution for May, simply because the magnetic tapes used for intermediate results for that month may have been erased and reused since then. Obviously it is uneconomic for the computer to print out long tabulations of all intermediates merely because of the possibility that some day the auditors might need to refer to them. Therefore, the auditor should make many of his tests during or immediately after the data for his selected period have been processed. He should also be sure that the machine room procedure calls for the retention of input data for a long enough time to permit him to refer to it during his test work.

Since the auditor often selects situations for further investigation on the basis of a review of final figures to see which items appear out of normal line, he will have to make such reviews promptly when he is dealing with EDP if the information to be investigated is to be conveniently available. Promptness of audit is also obviously necessary where test deck procedures are used. This is an interesting subject on which we will go into more detail later.

Unfiled Documents

Another problem is the relationship of the auditor to the paperwork which is immediately outside the computer function. It is essential that the auditor be able to refer on occasion to source documents. In an EDP system these source documents may be stored in batches and never manually filed into a logical sequence (for example by identifying code number). There is no easy solution to this problem, since the cost of refiling documents is considerable. In some cases a reference carbon copy of printed invoices or similar documents may be an aid. In other situations the use of batches identified by codes and limited in size may ease the look-up problem.

The audit of physical inventory differences may require changed auditing procedures. Of course, circumstances alter cases, since the

recording operation varies substantially with the nature of the industrial process. However, it is valuable for the company if the auditor can trace the bookkeeping history of products where significant inventory differences occur to learn whether the differences are due to erroneous physical counts, to process shrinkage, to errors in the accounting procedure, or to possible pilferage. If the computer operation is designed to produce analytic monthly activity reports on inventory, the auditor may well be able to use these to localize the causes for error. Since in many cases it is uneconomical for a computer system to maintain permanent records of the detailed activity of each product in the inventory, the introduction of EDP may lend emphasis to the desirability for continuous physical inventory counts throughout the year in place of the traditional complete annual physical inventory.

Audit procedures and EDP procedures are necessarily intimately related. Computer operations must be so planned as to permit the auditor to satisfy himself; the auditor's procedures must take into account the technicalities of the machine system. This does not mean that the auditor must be an experienced programmer or that the programmer must be a professional CPA. It simply means that the group which plans the computer operation must have a general understanding of audit purposes and techniques, so that it will have some sympathy with the auditor's problems. By the same token the auditor needs to develop a general familiarity with the powers and limitations of computers. As a practical matter, the internal auditor may well find that he can do certain of his assignments most effectively by setting up a team operation with a member of his company's procedures department. Similarly the public accounting senior may well work with a member of his management services division, especially during the planning phases of an audit which is concerned with EDP.

Audit Technique

There are some specific new audit techniques which are worthy of attention here. In his review of an EDP system, the auditor will wish to make sure that all reasonably possible machine logic checks have been included in the program. This certainly is a new and startling challenge when compared with the auditor's previous experience.

In this connection we should keep in mind not merely simple limit checks, such as a machine stop on any pay check larger than $200, but also more complicated limit checks which are made applicable only under specified conditions. There are interesting possibilities in programming the machine to question impossible codes. Some of these are rather obvious cases like that of labor charges applied to a material account; others are based on complex relationships within the company's product line or production sequence. Certain standard procedures are obviously necessary such as the programmed comparison of file identification in disk operations and the use of tape labels in order to prevent the use of the wrong tape with a given program.

The use of check digits can be valuable, but it is well to remember that this type of arithmetic will not catch everything. If the input includes items where the wrong code was initially selected, it is likely that the wrong codes will be checked out under the check-digit logic and will not be stopped. Double multiplication procedures may be worthwhile in certain cases, but it is necessary for us to use some judgment as to the cost in computer and storage capacity of such a procedure as compared with its value.

Obviously normal built-in machine checks are a substantial reassurance to the auditor. However, this is not an important subject currently since the majority of machines used in business are pretty well covered with duplicate circuitry, parity bit checks, double card reading checks, printer echo checks, and tape reading checks.

Systems Checks

The auditor will wish to put emphasis on reviewing the extent of systems checks which have been built into the program and related procedures. For example, he will be interested in the existence of good batch controls over the dollar or quantity totals of groups of input data for payroll, accounts payable, and receivables. The use of hash totals for control codes and similar figures will extend this philosophy of maintaining a precise relationship between

predetermined input totals and corresponding summaries reported by a computer.

The normal accounting proof totals which are useful in a manual system are also valuable in a computer operation. This covers not only the equality of debits and credits, but also the relationship between credits to accounts receivable and corresponding debits to cash and approved customer adjustments. Another example is the gross-to-net proof in payroll.

Report totals should also be subject to formal detailed control, so that batch totals are specifically reconciled with daily report totals, which are in turn tied in precisely with weekly and monthly report totals. This is not always as easy as it sounds.

There are times when the batch control philosophy is difficult to apply. Sometimes it is possible to use item counts, when predetermined dollar totals are simply impossible to obtain. On other occasions it is worth the cost to prepare adding machine totals for each batch by hand. Often, however, the batch totals are an almost automatic by-product of the first departmental handling of data, such as the opening of cash receipts. Under certain circumstances as in prebilling — it is reasonable to permit the first machine pass to establish the initial batch control total.

An Audit Tool

There is one area where the appearance of the computer opens up new opportunities for the auditor to do his work more economically or more effectively than it ever could be done before. This is in the use of the computer directly as a tool in audit work. One example of this might be the use of the machine to pick truly random items for audit tests. Another example might be the use of machine logic to pick all cases of certain specific types for special audit attention such as large balances, zero balances, high or low activity accounts, or other logical combinations of similar criteria. It is also possible for the auditor to use the computer to run trial balances under his supervision or to prepare certain types of figures, such as gross profit figures by product, or average hourly rates by department.

In much of this work the auditor can make effective use of test decks after a review of the normal requirements of a system. If he makes a rather detailed and careful study of the problem, followed by a more general survey of the programming philosophy which has been applied, the auditor can predetermine a collection of sample items to be processed by the machine. He can then calculate what results the machine should produce and see whether these actually are printed out. The test deck should contain not only the obviously typical transactions which are to be expected in normal business, but also the more unusual transactions which may not be properly handled by the program. Since the logical possibilities may be very involved, the development of appropriate test cases may require substantial amounts of study of the whole system. The programming group will have developed some test decks for its own use in checking the program initially, so it will be possible for the auditor to make some use of these in developing his own test deck. It would not be adequate, however, for him to borrow the programming group's test cases wholesale.

Installation Problems

When installing clerical procedures, it has normally not been customary to have the auditor involved in their planning. During the installation of punched card procedures some companies have brought in the auditor while others have waited until the system was installed. In the case of computer operations which are far more completely integrated from source document to final report, it is essential that the auditor be a member of the planning and installation team. If the auditor reviews programs before final debugging, he can suggest necessary changes at a time when they can be made without too great a cost. By the same token, it is best to have him delay his review until at least the general form of logic is established, so that he will not be devoting time to studying a program which the installation team later decides is unsatisfactory for operating reasons.

The auditor's principal purpose in reviewing the programs and the related clerical procedures before installation is to be sure that internal control is satisfactory, although he

will also keep his eye out for systems checks and other matters which we have already discussed. The auditor is in an excellent position to counsel during the debugging stage, and at this time he may be able to produce a test deck which will prevent errors in the system before it is started — obviously better than catching them later.

During the actual transition to computer operations, an auditor's judgment can be valuable in preventing too rapid a cutover, which could cause a temporary but serious loss of the controls we have been discussing.

An interesting aspect of the problem of installation of a new system is the preparation and purification of master decks of constant information. The experience of some of the insurance companies has been particularly enlightening in this connection. They have set up specific sub-routines to check each policy or each policyholder to be sure, for example, that the premium classification is logically consistent with other status classifications in the records. Frequently the use of machine logic in this connection has revealed errors which have been in the previous clerical or punched card system for years without being detected by either the company or the policyholder. A somewhat similar philosophy can be applied to the review of master addresses, master codes, and master rates which are being prepared for use in an industrial computer system.

Emphasis on Fundamentals

In this review of the subject of auditing and computers and the interesting relationships between the two, we have worked our way from general and fundamental aspects of auditing to specific technicalities. While EDP is full of complex and challenging problems of logic, the principal emphasis here is on the essential nature of auditing.

An auditor is not guaranteeing figures or pursuing criminals. He is assuring himself that the company's accounting system is designed so that reasonable methods are used to produce financial summaries. He is checking to be sure that the company's actual paperhandling practices are reasonably in accord with their stated procedures. In spite of the breadth of this purpose, the auditor relies primarily on two general tools: (1) The review of the effectiveness of internal control; (2) The use of selected test cases to find out what steps are being performed in specific cases. In one way or another, all of the fascinating new EDP technicalities must be related back to these simple fundamentals. **s/p/a**

SYSTEMS PERSONNEL

One area that is vital to the success of any program for the improvement of a company's management communication system is the calibre of the people that are assigned to developing and designing the systems concepts to be adopted. It is axiomatic that a company assign the highest quality personnel obtainable to this effort. Considering the high percentage of over-all operating costs that are involved in the operation of any company's management information system— and the vital effect that its efficiency or inefficiency has on the effectiveness of top management by furnishing bad or incomplete information as compared to sound and necessary information— the cost of assigning the best obtainable personnel during the system development phases is small indeed.

Too many managements have attempted to accomplish their systems planning effort with people who do not have the inherent abilities to accomplish the task. As a result, these managements continue to limp along with inadequate systems and with resulting poor management information for operating decisions and for long-range planning efforts. It is much simpler to set down the logic of problems in the physical sciences than it is to set down the assumed logic of a business executive when he is making a decision based on incomplete data. Electronic data processing has become a by-word in the evolution of techniques for a scientific approach to the problems of management. This equipment is not an end in itself and cannot be considered a panacea for the ills of management. Too many people place emphasis on the equipment and not enough on definitions of the problems of management and on the development of logical management information systems. In systems work it should be a goal to develop a powerful integrated management communication and information processing system. High stakes are involved; the results warrant an all-out effort. (*Norman J. Ream, Executive Vice-President, SPA.*)

Communications – An Important Systems Tool

John J. Murphy

▶ The complex of American business provides an unending series of problems. One of the most intriguing and common is the problem of communications. By definition, an organization is "an association of individuals to accomplish a given purpose." Business cannot function without communication between the individuals who comprise the business. Yet, how often does the common characteristic, communications, become the common failing. The result may be as simple as to cause restatements, clarifications, backtracking, and time wasting; or may lead to the more serious consequence of loss of job or loss of customers.

To understand the problem of communications, we must look deep into the human characteristics involved. What happens when we begin to communicate? What are the reactions of the speaker and the listener?

Holding Attention

Communications is a two-way street. One must express a thought, the other must absorb that thought *in the way the expressor intended it*. This assumes attention on the part of the listener, and this attention is not as easy to acquire as it appears. In normal business conversation, your words are an interruption of the thought process of your listener. The outward expression may imply full attention, but the inward thought process may continue on the previous subject. In business conversation, one is generally trying to sell a thought or an idea. These ideas often mean an increase or change in the workload of the listener. As a result, the thought process begins to concentrate on excuses rather than attention to the speaker. The mind of your audience is as elusive as an eel, although the outward appearance may indicate undivided attention. Attention must be captured if communication is to be effective.

Conveying Thought

Having captured the attention of the listener, we proceed to the next problem — conveying the thought so that it is absorbed in the way the expressor intended it to be.

As one speaks, a series of phantasms or mental images flashes through the mind. If you will concentrate for a moment on the following words, a mental image will come to mind:

Automobile—Work—Fun—Home

To each mind comes a different image. The source of these images is our own background and experience. The word "fun" may imply sailing to one, hunting to another, bowling to a third. These are simple examples. But, were the words "Einstein's Theory of Relativity," to one mind might come a clear-cut example,

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to another a vague picture of Einstein working at a blackboard, to a third may come a complete blank. Why? Because of limitations in background and experience. As one proceeds in conversation, a series of mental images form to help lead us to the ultimate conclusion. If the series formed by the listener differ from the series formed by the speaker, the result is an incomplete communication. The speaker's ability to communicate with the listener is limited by the listener's ability to understand the speaker. The listener's ability to understand the speaker is limited by the listener's experience and ability to form a series of mental images which closely relate to the series the speaker formed while talking. If the listener cannot do this, or the speaker cannot present the material in a manner which allows this, then the communication is indeed incomplete. Good communications depend not on what you tell the listener, but on what he *accepts* of what you tell him.

Solution

The solution to the communication problem is not an easy one, but several steps can be taken to improve communication.

1. Recognize the problem. Recognize that normal, intelligent people may not accept what you say in the way you intended.
2. Look for signs of incomplete communication; the puzzled look, the lifted eyebrow. If you are not sure, say it again from another approach.
3. Be sure you have the attention of your listener. Talk around the main topic for a few moments, allowing his mind to focus on the subject.
4. Consider the background and experience of the listener. Talk in terms which fit this background. Use terms which lead him to the same conclusions by allowing him to form the same mental images.

Communications is a basic tool of the systems man. It does not matter how well he writes, how well he knows his subject, or how brilliant his solution to the problem; unless he can put his ideas across to the man who must use them, his ability is ineffective.

s/p/a

*Richard W. Reynolds**

*This is the last issue in which Mr. Reynolds will serve as book review editor. Thanks, Dick, for a job very well done.

Business Experience with Electronic Computers, *by B. Conway, J. Gibbons, and D. E. Watts; Controllers Institute Research Foundation, Inc., 2 Park Avenue, New York, N. Y., 191 pp., 1960, $5.*

A research study reported by three directors of Management Advisory Services, Price Waterhouse & Co., this book has a significant place among the many fine studies published by the Controllers Institute Research Foundation. Its purpose is to present a synthesis of what has been learned so far from electronics data processing installations—"pioneered" electronic data processing installations. A hundred or so companies provide the raw data of experience from which valuable lessons are drawn.

The authors have done the job well: results are well organized, style makes the reading easy and conclusions are fair.

Business Experience with Electronic Computers is divided into five parts: Part I, *Making the Division;* Part II, *Preparing for and Introducing Electronic Equipment, Company Education, and the Programming Group;* Part III, *Development of the Applications and Conversion from Prior Methods;* Part IV, *Operating Electronic Equipment;* Part V, *Relations with the Manufacturer;* and Part VI, *Some Unresolved Matters and Some Thoughts on the Next Five Years.*

The reviewer is tempted to say that this book is essential reading for all top management personnel of any firm large enough to support the possibility of EDP. It is certainly recommended reading for every Controller and for any systems man even remotely connected with EDP. As a collection of lessons learned to date on the management problems in connection with EDP installations, it would seem that the book belongs in every systems library.

Classics in Management, *edited by Harwood F. Merrill; American Management Association, 1515 Broadway, New York 36, N. Y., 446 pp., 1960, $9 non-members, $6 members.*

Today the systems man who continues to study *management* finds the newer "management science" bordering him on every side. Many of the contributions to the newer concepts come from psychologists, mathematicians, or sociologists who, deliberately it seems, have neglected to read the management "classics." The student of management will find it both balancing and refreshing, therefore, to read this book which is probably the first and only anthology of classical management thought.

Most of us have been exposed in detail to a management classic or two in our formative years. However, few of us have had the opportunity to study the flow of management concepts over the past century. Many of the classics have been hidden in private collections or scattered in reference libraries. *Classics in Management* aims to bring together, in their original form, writings which make a foundation for modern management practice.

Included in the publication are excerpts from the works of Robert Owen, Charles Babbage, Henry Metcalfe, Henry R. Towne, Frederick W. Taylor, Henry L. Gantt, Russell Robb, Harrington Emerson, Alexander H. Church, Henri Fayol, Frank B. Gilbreth, Oliver Sheldon, Mary Parker Follett, Harry Arthur Hopf and George E. Mayo. The clarity of ideas expressed in each excerpt helps to leave an impression on the reader.

On the flyleaf of the cover appears the following comment: "*Classics in Management* belongs on the shelf of every manager who believes that he is a professional worker in a field with a history, a heritage, and a future." This reviewer endorses that statement.

Computers and How They Work, *by James D. Fahnestock; Ziff Davis Publishing Company, One Park Ave., N. Y. 16, N. Y., 288 pp., 1960, $4.95.*

Many systems men go deeply into electronic data processing problems without satisfying their curiosity as to what makes EDP equipment "tick." Generally this is because literature available to them on the subject is either over simplified or is heavy Einsteinian material.

Computers and How They Work is a presentation of technical principles about computers and periphery operations. It is in language that a non-electronics engineer can understand easily. It gets basic ideas across directly. Some 113 illustrations provide information about fundamental aspects of computer language, arithmetic programming, and circuitry; the means of communicating between men and the equipment; and the way in which a computer remembers. The book is not concerned with applications.

Although it is not vital that an EDP systems man be familiar with basic technical principles underlying EDP equipment, few will deny that added perspective afforded by such knowledge gives them more confidence and helps them do a better job. With this in mind, the book is recommended for persons who are involved in or who expect to be involved in EDP planning.

Engineering Data Processing System Design, *by Arthur D. Even; D. Van Nostrand Company, Inc., Princeton, N. J., 282 pp., 1960, $6.50.*

This book contains a comprehensive coverage of mechanization possibilities for processing engineering drawings, engineering parts lists, and other engineering documentation. The author considers every aspect of an engineering department's data processing problems. Primary documents, basic records, and the approach necessary to design engineering system—with all of the ramifications involved —are thoroughly discussed. The author combines engineering, data processing, microfilming, and punched card handling into an integrated mechanized system.

The writing style of this book is simple and lucid. The reader has a minimum problem in understanding what is written. At the same time the "know how" expressed in the book is so impressive that the reader may be convinced that he could handle any data processing task in an engineering department simply by holding the book open and reading as he goes along. A good glossary helps to erase the last vestige of mystery in engineering a data processing system.

Financial Incentives for Management, *by Richard C. Smyth; McGraw Hill Book Co., New York, 309 pp., 1960, $8.50.*

Often the solution to a vital systems problem pivots on the organization's ability to attract, retain, and motivate competent management personnel. In many companies, such problems are approached on a catch-as-catch-can basis. In contrast to the huge amount of material written on compensation plans for rank-and-file employees, little has been written about compensating and motivating management personnel. This well-organized, rather complete book by Mr. Smyth develops this point of view and should be welcome, therefore, in the world of management.

Experienced systems people will appreciate the philosophy propounded by Mr. Smyth. It seems that carefully studied and tailor-made *plans* to meet objectives are as necessary for financial incentives design as for data processing systems design. Examples of incentive plans, techniques, and concepts put into action by various companies are described in full. Chapters on organizational analysis, managerial evaluation, salary administration, deferred compensation, and stock option plans are included. An appendix of 121 pages describes the plans in force at specific "blue chip" companies.

This book is recommended highly. It gives a good perspective of an area important to the system's mans personal situation as well as to his work problems.

Principles of Engineering Economy, *Fourth Edition, by E. L. Grant and W. G. Ireson; The Ronald Press Company, New York, 574 pp., 1960, $8.*

This is a book about decision making relating to capital expenditures in an organization. Completely rewritten, a considerable amount of new material has been introduced throughout the various chapters of this fourth edition. The book can be used most effectively as a text, but will serve as a major assistance to anyone who is expected to contribute towards decisions and recommendations relating to capital expenditures in an organization.

The same concepts and methods that are helpful in guiding decisions about investments in capital goods are useful in making decisions between alternative types of financing (for example, ownership versus leasing) and in making personal decisions. Applications to these areas of decision making are also discussed in this book.

Typical titles of chapters are; Interest Problems, Calculating a Prospective Rate of Return, Some Aspects of Depreciation Accounting, Dealing With Multiple Alternatives, Some Income Tax Considerations in Decision Making, and Establishing Criteria and Procedures for Investment Decisions.

There is more in this edition of *Principles of Engineering Economy* than can be absorbed in a weekend reading. Proficiency in using these principles comes only with study and practice. However, the perspective that even a light reading will give, can make this book important to the systems man who expects to take part in major acquisition decisions.

s/p/a

AN EDUCATOR'S POINT OF VIEW

▶ Schools of business are sometimes criticized by students and business because of special pre-business and upper division core requirements in their degree programs. Pre-business or lower division requirements commonly include such courses as mathematics, public speaking, business statistics, economics, and accounting. Upper division core course requirements might include finance, marketing, production, organization theory, personnel management, business policy, and business cycles. The purpose behind these requirements, in part, is to provide some assurance that all students will receive an insight into the several functional areas of business. Emphasis is thus on a broad background in business for the student's elected major field or option. Indeed, such an approach to business administration is conductive to the student's viewing a business firm as an integrated *system.*

Unfortunately, perhaps, single courses in systems are too often labeled "accounting systems" and often require burdensome accounting prerequisites. This seems to imply that systems and procedures work is identified with accounting data only and indicates that the accountant is the only one particularly suited to this important function in business. Needless to say, some of the best potential systems and procedures personnel might be students majoring in marketing, production, finance, and general management. For this reason it seems highly desirable to develop a systems course from a broad management information point of view in order to attract business administration students from areas other than accounting. Indeed, such a course might conceivably be a core course, if logically organized and developed.

While schools of business do not as a rule directly prepare students for systems, procedures, and methods work, they do attempt to provide some of the basic tools necessary or desirable for potential positions or careers in this important area.

Schools of business commonly have an educational philosophy which does not permit the inclusion of vocational types of courses in their curricula. For example, while students might be introduced to the conceptual aspects and potential uses of computers and data processing equipment, technical courses in programming specific machines are not offered for credit. Therefore, while certain courses might point toward systems and procedures work, most schools are not equipped to provide an on-the-job type of training for students attracted to systems work. To some extent, this training might be provided by cooperation between educators and systems and procedures personnel within business, industry, and government. Assistance from industry can be furnished by way of visiting lecturers, case studies, and films. One of the greatest sources of help is the growing body of business literature to which important contributions are continually being made by experienced personnel in industry. In return, educators can provide industry with speakers in various functional business areas, research assistance, and seminars or conferences.

This type of broad educational program, supplemented to some extent by cooperative efforts of educators and industry personnel, is not only desirable but essential to attracting and developing high caliber potential systems personnel.

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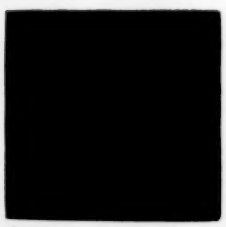
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